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SKYLAB FIFTH PROGRESS REPORT
Fractures and lineaments of Sicily island
Preliminary results on analog optical techniques

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In the framework of the studies carried out with the aid of the Skylab images an additional topic of investigation is the geological structure of Sicily outside the volcanic area.
On the occasion of the ESRO meeting held at Frascati (Jan.28, 1974) the first results by ERTS-1 imagery were presented (ref.: 1).
At the present time this interpretation is performed by means of both ERTS-1 and Skylab imageries and by aerial photographs of some strips in the Central part of the Island.

While with the ERTS images, and in particular with bands 5 and 7, probably due to the season, the largest lineaments seem to be very well detectable, with the Skylab photographs some difficulties arose because of the season and the smoother responsivity of the simple bands.

The lineaments are drawn easy enough only if interpreted with the key of the false colour and/or the multispectral composition analysis. This fact happens probably because of many different causes describing the same structural phenomenon: fractures, moisture content and vegetation behaviour seem to be joint factors indicating the continuity of the faults.

After having drawn a first thematic map "by pencil and eye" on the false colour images, an accurate study was carried on the stereo pairs of B & W aerial photographies covering part of the area interested by a unknown fault system crossing the island in N-S direction.

Then the interest was pointed on a number of small fractures distribued over the whole Sicily.

An attempt was made, using the ERTS-1 band 7, as well as the infrared band of SL-3 multispectral camera

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to recognize the averaged trend of the system of faults in the central part of Sicily (ERTS-1 - NASA Final Report - Contribution of Space Platforms to a ground and airborne remote-sensing programme over active italian volcanoes. Nasa Contract FO-Ø 13) by using the derivative function applied in absolute value and plotted versus the image scanning direction. The result indicated as main trend of the central part of the island the NE-SW direction.

But the influence of the scanning lines was large in comparison with the maximum possible resolution. With the Skylab images a new analog method have been applied.

We tried to employ the maximum resolution available in order to better discriminate the targets which lead to the whole lineament through their distant correlation.

We applied, for each band, the negative support on the corresponding positive, giving at the same time a small and costant shift in two orthogonal directions.
The resulting density is given by:

$$d\ a(x,y) - d\ a(x+\Delta x,\ y+\Delta y) =$$

$$\gamma \log a(x,y) + d_{max} - \gamma \log a(x+\Delta x, y+\Delta y) =$$

$$\gamma \log \frac{a(x,y)}{a(x+\Delta x, y+\Delta y)} + d_{max}$$

where:

$a\ (x,y)$	=	intensity of band a in x,y
$a\ (x+\Delta x, y+\Delta y)$	=	intensity of band a in $x+\Delta x, y+\Delta y$
γ	=	contrast of the photographic material
d_{max}	=	maximum density of the photographic material.

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The ratio stresses out the presence of a discontinuity existing between the points (x,y) and (x +Δ x,y +Δ y) i.e. the "derivative" function of a (x,y) in both x and y directions.
This kind of enhancement applied to different bands leads to a better understanding of the correlation factors.

In this way discontinuities were discovered, the longest ones mainly in NE - SW direction, the shorterst along a coniugate axis.

The displacement used was just a little greater than the resolution of the photographs microcontrast of the employed duplicating film.

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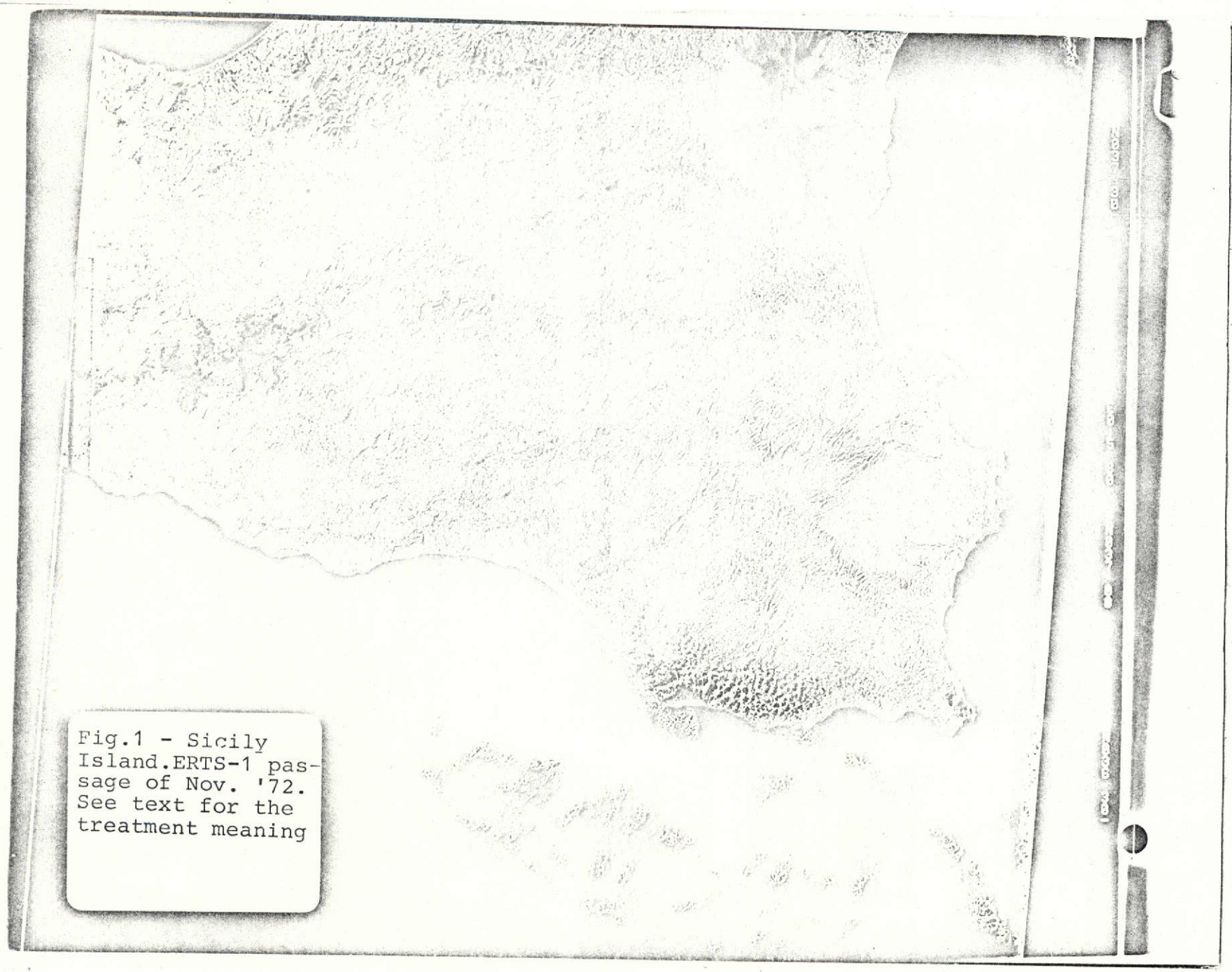

Fig.1 - Sicily Island.ERTS-1 passage of Nov. '72. See text for the treatment meaning

Fig.2 - Sicily Island, SL 3 passage of Sept.'73. See text for the treatment meaning